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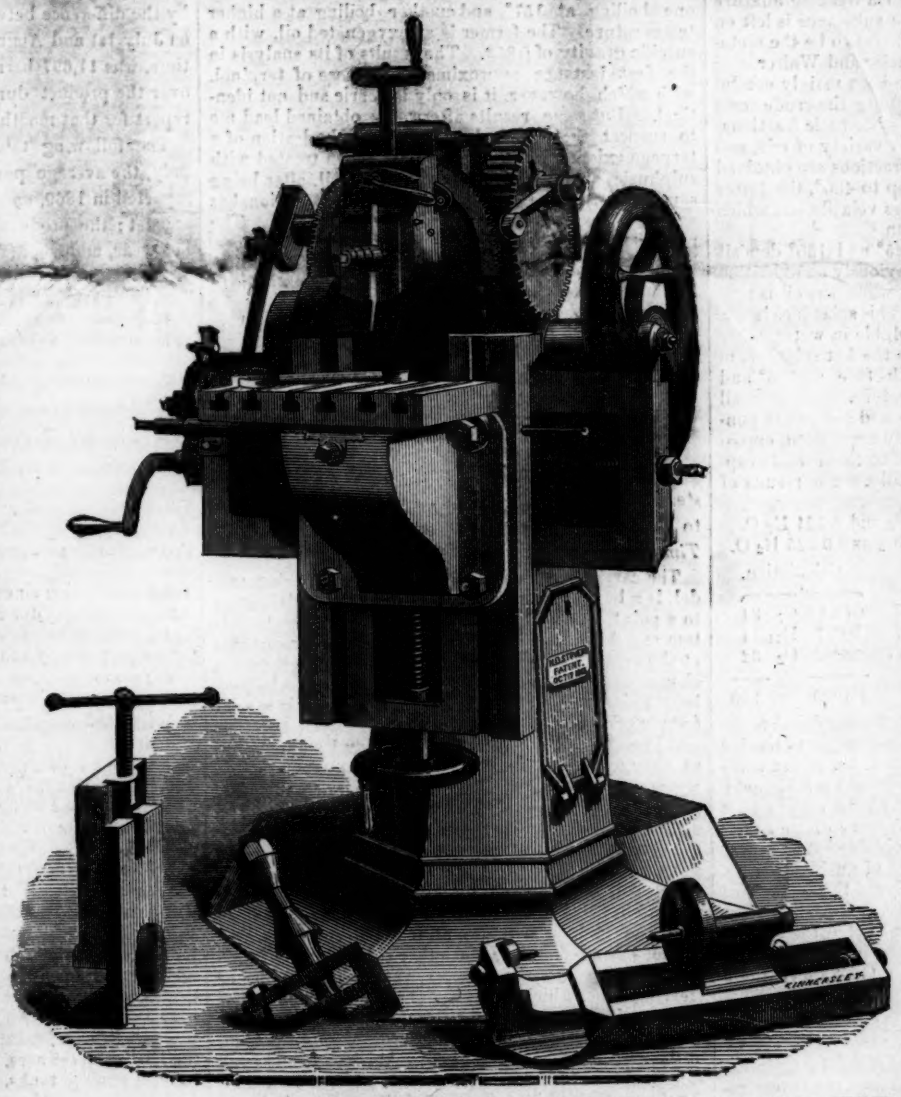
Shaping Machine.

We present to our readers this week, a cut of one of the most economical machines used in a machine shop, and one in which the greatest economy lies in the amount of work it will perform, and which in completeness of detail is unsurpassed—a poor tool will do a certain amount of work, but in the end are more expensive than one made by a first-class manufacturer, whose reputation is at stake on every machine they build, for it is impossible to produce a tool adapted to its work, and with completeness of detail, with perfect fittings, heavy in all its parts, and such as will withstand the heavy wear and tear required of it, and always do accurate work without having it made by such a manufacturer. We have examined the tools built by H. D. Stover, and can pronounce them perfect in every respect.

The cut represents his 8-inch shaping machine, which has a cutting bar of 8 inch stroke, tool head with anguear and circular movements, crank motion with hand or power; table has horizontal and vertical movements and circular work attachment; has self-operating horizontal and circular feed; planes round, hollow, and flat surfaces. The machine is delivered with vices, centers, and flat table. Tables swivel on any angle, and can be clamped in any position. It is in every way a compact machine.



SHAPING MACHINE.

For further information apply to H. D. Stover, No. 117 Liberty street, New York City.

Engine Efficiency Independent of Boiler.

In the ordinary mode of comparing the duty of steam engines by determining the quantity of coal necessary to develop a given power, the efficiency of the boiler is not distinguished from the efficiency of the engine. Messrs. B. W. Farey and Bryan Donkin, of England, have recently made some interesting experiments with an apparatus designed to measure directly the heat carried away in a condenser. Measuring at the same time the work developed by the engine, by means of indicator diagrams, all the elements are ascertained, necessary for determining the efficiency of the engine, independently of the boiler. The quantity of water passing through the condenser is measured by conducting it over a weir or notch. The temperature of the condensing-water on entering the condenser, and that of the mixture of injection-water and condensed steam leaving the condenser, is ascertained by ordinary thermometers; lastly, the work done in the cylinder is ascertained by indicator diagrams. Dividing the horse-power developed in the cylinder, expressed in thermal units, by the quantity of heat imparted to the injection-water in thermal units, the quotient expresses nearly the efficiency of the steam. And since the efficiency of the steam in the same engine does not vary much for moderate variations of power, when the efficiency of the steam has once been ascertained, the measurement of the volume and temperature of the injection-water affords a new means of ascertaining the work done by the engine, Messrs. Farey and Donkin have therefore contrived photographic registering apparatus, by which the volume of flow and temperature of the injection-water are continuously recorded; the data so obtained being used either to determine the efficiency of the steam or, to determine approximately the power of the engine.—*Min. & Sci. Press.*

Explosion of Meteorites.—The *Journal of the Franklin Institute* translates the following from *Les Mondes:*

"M. Swaim proposed before the Acanemy of Sciences the following explanation of the detonating explosion of meteorites. It has been proved that usually the aerolites which reach the sphere of the earth's attraction, contain a large proportion of hydrogen. Is it not then probable that in their passage through the atmosphere, they also absorb a large amount of oxygen or air, so that the mixture of the two gases becomes explosive, and in fact explodes when the temperature either from resistance or the friction of the air becomes of sufficient intensity?"

Water Meters.—This will be the subject at the next meeting of the Society of Practical Engineering.

Preliminery Note on the Products of the Destructive Distillation of Resin.

By Thomas Anderson, M·D., F.R.S.F., F.C.S.,

I have been engaged for several years in the investigation of the distillation products of resin. The subject having proved one of great extent and complexity, it was not my intention to have made any part of it public until it was more complete than it is at the present moment, but the recent appearance of a similar investigation by Mr. Tichborne has induced me to alter this intention and to publish my results, especially as some of them differ from those which he has obtained.

When common colophony is distilled, the first product is a small quantity of a volatile oil, commonly known as "rosin spirit," consisting of some products of decomposition of the resin contaminated with a portion of the essential oil originally existing in the terpentige. When this is separated, an oil is obtained which becomes more and more viscid as the distillation proceeds and shows a gradually increasing blue flourescence as the temperature rises, and at last a small quantity of charcoal is left in the still. When this crude resin oil is rectified, the first product is a "rosin spirit," larger in quantity and somewhat different in smell from that obtained in the first distillation. This is followed by a mixture of thick oils of high boiling point, and the last product, if kept separate, acquires, on cooling, the consistency of soft butter, or rather of a mixture of oil and butter. When this is exposed to a freezing mixture and expressed, a solid crystalline substance is left on the cloth, which, when purified, proves to be the metanaphthaline or retisterline of Pelletier and Walter.

My investigations hitherto have been mainly confined to the spirit obtained in rectifying the crude resin oil. When this is submitted to a systematic fractionated distilation, it splits up into a variety of oils, and after seven or eight refractions, fractions are obtained at all temperatures, from 70°C. up to 400°, the latter being of course portions of the less volatile oils which passed over at the first rectification.

The fractions boiling between 125° and 150° deposit a crystalline substance, which is obviously an oxidation product, and increases in quantity when the oil is preserved in partially filled bottles. This substance is Mr. Tichborne's colophonine. It is soluble in water, ether and alcohol, and is deposited from the hot solutions in long needle-shaped crystals, which fuse at 106° and sublime easily at a higher temperature. Their smell is aromatic, and they have a warm and somewhat pungent taste. They were purified by expression, exposure to the air until the oil attached to them had evaporated, and then subliming repeatedly. The results of combustion were as follows:

(I.) 0·425 gramme gave 1·004 CO_2 and 0·424 H_2O.
(II.) 0·2225 gramme gave 0·526 CO_2 and 0·225 H_2O.

	I.	II.	Calculation.		
Carbon.....	64·34	64·47	64·61	C_7	84
Hydrogen.....	11·09	11·24	10·77	H_{14}	14
Oxygen.....			24·62	O_2	32
			100·00		130

This corresponds completely with the empirical formula $C_7 H_{14} O_2$ which bears a simple relation to terebic acid, $C_7 H_{10} O_4$. I have endeavored, but as yet without success, to convert this substance into terebic acid, by means of oxidising agents. By strong nitric acid it is converted into oxalic acid, with more dilute acid a resin is produced, but I have not obtained it in sufficient quantity to admit of any process of purification being applied to it. Not having analysed the crystals of this substance deposited from water, I failed to detect Mr. Tichborne's hydrate of colophonine, but the composition he gives for it is not altogether inconsistent with my formula, for a hydrate $C_7 H_{14} O_2 + H_2 O$ would give—

Carbon	56·75
Hydrogen	10·81

The oils contained in resin spirit are very complex, and consist of a mixture of hydrocarbons, the investigation of which is still quite incomplete. The most volatile fraction, which was very small and boiled between 70° and 80°, contained a volatile acid, apparently accetic acic, which gave abundant white fumes with ammonia. After separation of this acid by washing with water and dying, the oils gave—

Carbon	84.62
Hydrogen	13·71

Though the oils obviously contains oxygen, these numbers approximate to the composition of an olefiant, and its vapor density was 3·257, agreeing sufficiently with 3.386, which is the theoretical number for heptylene. The oil is probably a mixture of this substance with some oxygenated product, but the quantity at my disposal did not permit of any process of separation being employed.

At the temperature of 107° a larger quantity of oil was obtained, also containing oxygen. It gave, no combustion—

	I.	II.
Carbon.....	85·90	86.44
Hydrogen.....	12·75	12·79
	98·65	99·41

in which the carbon agrees with that of an olefiant, although the hydrogen is deficient. As far as analysis is concerned, the oil appears to be homogeneous, for, on rectifying it and separating the first few drops and the last few drops of the distillate, they were found, on combuston, to give identical results. The action of reagents, however, leads to an opposite conclusion. When digested for some time at 220° with strong hydriodic acid, it is converted into a black oil heavier than water. This, after being washed with potash and dried, yielded on distillation two oils, one boiling at about 177°, which containg iodine, it partially decomposed by distillation, and for which no formula could be obtained—and a non-iodised oil, very viscous, with a green fluorescence, and boiling at 290°. On combustion, it gave the following results:

	Experiment.	Calculation.		
Carbon.....	87·94	88·24	C_{10}	120
Hydrogen.....	12·19	17.76	H_{16}	16
	100·03	100·00		136

It is therefore a terpene apparently corresponding with the colophene or metaterpene of Berthelot.

Of the less volatile oils, I have as yet examined only one boiling at 157°, and another boiling at a higher temperature. The former is an oxygenated oil, with a specific gravity of 0·853. The results of its analysis in the first instance approximated to those of terpinol, with which, however, it is only isomeric and not identical. But some results afterwards obtained lead me to suspect that it may be a product of hydration of a terpene existing in the crude oil. When treated with sulphuric acid, heat is evolved and the oil, after being separated from the acid and purified by distilation, has exactly the smell and composition of terebene. The products at higher boiling points appear to be terpenes, but they give no solid hydrochlorates, and their separation presents difficulties which I have not hitherto been able to overcome.

I trust I may be able at some future period to throw further light on the constitution of these substances; my investigation of which must be considered for the present as entirely preliminary.

The Aerial Steam Carriage.

So much has been heard and said about the "aerial steam carriage" in San Francisco, that we give place to the following description from the San Francisco *Times*:

The carriage, which is merely a large working model, is a balloon, shaped like a cigar, both ends coming to a point. It is 37 feet long, 11 feet from top to bottom and 8 feet in width. These are the measurements at the center of the balloon, from which point it gradually tapers off toward either end. Around the balloon lengthwise, and a little below the centre, is a light framework of wood and cane, strongly wired together and braced. Attached to this frame, and standing up as they approach the front of the carriage, are two wings, one on either side. They are each five feet wide at a little back of the center of the carriage, and do not commence to narrow down until they approach the front, where they come to a point. These wings are made of white cloth fastened to a light framework, which is braced securely by wires. The main frame is secured in place by means of strong ribbons, which go over the balloon and are attached to corresponding portions of the frame on the other side. To the frame at the hind part of the carriage is attached a rudder or steering gear, which is exactly the shape of the paper used in pin darts, four planes at right angles. This, when raised or lowered, elevates or depresses the head of the carriage when in motion; and when turned from side to side guides the carriage as a rudder does a boat. At the center and bottom of the balloon is an indentation, or space left in the material of which it is built, in which the engine and machinery are placed on framework. The engine and boiler are very diminutive specimens, but they do their work handsomely. The boiler and furnace are together only a little over a foot long, four inches wide and five or six inches in height. Steam is generated by spirit lamps. The cylinder is two inches in diameter and has a three inch stroke. The crank connects by means of cog wheels, with tumbling rods which leads out to the propellors, one on either side of the carriage. The propellers are each two bladed, four feet in diameter, and are placed in the framework of the wings. The boiler is made to carry eight pounds of steam. When not inflated, the carriage weighs eighty-four pounds. The balloon has a capacity of 1,360 feet of gas. When inflated and ready for a flight it is calculated to have the carriage weigh from four to ten pounds.

An engineer's private trip was first made in the presence of the constructing engineers, several of the shareholders of the Aerial Steam Navigation Company, a number of the employés and residents in the neighborhood. The morning was beautiful and still—scarcely a breath of air stirring. The conditions were favorable to success. The gasometer was fully inflated, and the model was floated out of the building. In six minutes steam was got up—the rudder set to give a slight curve to the course of the vessel—and the valves opened. With the first turn of the propellers she slowly rose into the air, gradually increasing her speed until the rate of five miles an hour was attained. The position of the rudder caused her to describe a great circle, around which she passed twice, occupying about five minutes each time. Lines had been fastened to both bow and stern, which were held by two men, who followed her track, and had sufficient ado to keep up with her at a "dog trot." As she completed describing the second circle, a pull given to the head line, unintentially, caused the rudder to shift to a fore-and-aft position, when the model pursued a straight flight about a quarter of a mile; she was then turned round, and retraced her flight to the point of departure; whence, being guided, she entered the building. The fires were drawn, and the first extensive flight of a vessel for aerial navigation was accomplished. The total distance traversed was little over a mile.

Petroleum in Pennsylvania.

The production during the month of July, as shown by the difference between the stocks held in the region on July 1st and August 1st, and the shipments meantime, was 11,697 barrels of 43 gallons, or an increase over the product during June, as shown by a revised report for that month, or about 400 barrels.

The following table shows the production during July, the average per day, the production previously reported in 1869, and the average per day since January 1st; the product from January 1st to August 1st last year, and the average per day for the same time:

	Barrels.
Total shipment of crude for July of bbls. of 45 gallons each..	353,281
Add to reduce to bbls. of 43 galls. each.....	16,436
Total shipment of bbls. of 43 galls. each.....	369,717
Stock on hand July 1st.....	314,246
Stock on hand August 1st.....	307,136
Deduct decrease on August 1st.....	7,110
Total production during July..... ..	362,707
Average per day for 31 days.....	11,696
Production from January 1st to July 1st ...	1,893,381
Total production since January 1st.....	2,256,988
Average yer day for 212 days.....	10,641
Total production same time last year.....	2,021,206
Average per day same time last year, 213 days.....	9,489
Average per day during June last year.....	10,698

With the exception of a falling off in the product of the farms in the Bull Run district, there appears to have been no decrease of consequence. In the Pleasantville district there was a slight decrease. The product as obtained from the difference between stocks at the beginning and close, and the shipments during the month averaged about 1,200 berrels daily.

Under continued large shipments, the stock of oil in the region underwent a further decrease during July, and on August 1st the total was 370,136 barrels and 43 gallons. During the second two weeks of the month the shipment was light, and the stock accumulated rapidly, but during the last week the shipments by all routes were greatly enlarged.

In the stock of August 1st there was included the amounts in iron tankage and at the wells, and those on the hands of refiners, dealers, and pipe companies in wooden storage tanks. These last amounts aggregated 12,450 barrels, and were located as follows: At Titusville 2,000 barrels, at Miller 1,500, at Pithole 1,000, at Tidioute 1,000, at Petroleum Centre 4,450, on Cherry Tree Run 2,000, and on the Rynd Farm 1,500.

Three hundred and ten wells are going down on the 1st of August.

The shipment of crude equivalent during July reached a little over 353,000 barrels, of 45 gallons each, or a daily average of 14,000 barrels.

The number of wells in process of drilling increased slightly during July, and on August 1st the total number was 310, an increase of 5. Besides the above there were about 60 leases on which operations had been commenced with a view to sink wells.—*Titusville Herald.*

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[We are unable to get ready, in time, reports of subjects brought before the American Association at Salem, such as were contemplated in our last. This has arisen from the circumstance that the undersigned, who had intended giving his time, at Salem, to the collection of such materials, received the unexpected (and undeserved) honor of election to the Secretaryship of the Section of Physics and Chemistry; and his time was therefore fully occupied; so much so, in fact, as frequently to prevent his hearing most important papers and discussions. Part of the deficiencies thus arising may, in time, and with some considerable labor, be supplied.—HENRY WURTZ.]

American Chemical News.

NOTE ON THE WOLLONGONGITE, A REMARKABLE HYDRO-CARBON FOUND IN THE WOLLONGONG DISTRICT OF THE ILLAWARRA COAL FIELD, N. S. WALES.

BY B. SILLIMAN.

[The following article is somewhat abridged from the original. H. W.]

In the course of a research conducted by Prof. H. Wurtz and myself, lately, on the Hydro-carbon Gas Process, my attention was recalled to a peculiar kind of cannel coal from Australia, which was brought to this country in 1866, by Mr. Hall of Australia, from whom I obtained my first knowledge of its existence. As it turns out on examination to be by far the most remarkable substance of its class hitherto discovered, I propose to discribe it.

It is found in the Wollongong district of the Illawarra Coal Fields, New South Wales, and in the range known as the Kembla Mountains, or Blue Mountain range. The locality appears to be a recent discovery, as the section taken down from Mr. Hall's dictation is quite different from any section given by Prof. Dana in his account of the Illawarra coal field.

(Report on the Geology of the Countries visited by Wilkes's U. S. Exploring Expedition, pp. 449, et seq; accompanied by map of the Illawarra coal field, in which the Wollongong mineral exists. This remarkable mineral was discovered long subsequent to the date of Prof. Dana's explorations in 1840. The writer examined and analyzed the coals brought home by Prof. Dana from Australia, which analyses are published on page 476 of the Report quoted. But among them there was nothing at all resembling the remarkable body now for the first time, as he believes, introduced to the knowledge of gas chemists.)

The remarkable substance which is the subject of this note has been observed only in one place, about 250 feet above tide, and five miles inland at a point about 40 miles south of Sidney. Its mineralogical characters are as follows:

In cubical blocks without lamination. Breaks in broad conchoidal surfaces, extremely tough and resounding like hard wood under the blows of the hammer.

H.—2 to 2·5. G.—1·04—1·49. Luster resinous, somewhat silky. Color greenish black and brownish black. Streak light brown to yellowish. No odor when rasped. Tasteless. Sectile, the thin shavings curling up under the knife. Not electric by friction of the mass, but the chips cut off by the knife are highly electric. Translucent in thin shavings and under the microscope transmits amber yellow light. Alone in a test tube does not melt, decrepitates and distills a copious flow of oil of a yellow color and heavy odor, giving off much gas.

Insoluble in alcohol, ether, or benzole, but is slightly dissolved in carbonic disulphid to which it imparts a slightly yellowish tinge.

It is readily kindled in thin splints by a match, burning with a brilliant flame and much smoke. The analysis in a platinum crucible yields the following results.

Volatile matter	82·5
Fixed carbon	6·5
Ash	11·0
	100·0

From these characters this substance obviously resembles succinite and is probably as well entitled to a place in the system as bathillite or torbanite. An ultimate organic analysis of the mineral is required before its true composition can be ascertained. It may provisionally be called *Wollongongite*.

The following technical results were obtained by us at the experimental gas laboratory of the Manhattan Gas Light Company, in New York, made with a view to determine the technical value of this mineral as an enriching material in gas making.*

Average yield of (5 charges) gas per ton	13,716 cubic feet.
Coke (very light and lustrous)	420 lbs. per ton.
Illuminating power of 5 feet of gas burned in Scotch fish-tail burner	132·94 candles.
One bushel of lime purifiers	5686 cubic feet.
Gas from one ton equals sperm	6251·26 lbs.*

The gas obtained was so rich that its illuminating power could be measured only by diluting it very largely with common street gas of known power. Even when 10 per cent of the Wollongong cannel gas was added to 90 per cent of street gas, whose illuminating power was 14·98 candles, it was found still too rich to burn in the 15-hole standard Argand. But it could be burned, however, at the rate of five cubic feet in a Scotch tip fish-tail burner, giving from the mixture an illuminating power of 26·54 candles. From these data, the candle power of one cubic foot of the gas of this material is equal to 26·59 candles—a degree of illuminating power unexampled, so far as we are informed, in the records of gas making from any material heretofore examined. This appears more clearly on comparing this result with some of the best known of the cannels of England and the United States, thus:

Wollongong cannel	—lbs. of sperm per ton,		6251·26	26·54
Boghead cannel	— " "		†1967·10	
" "	— " "		‡2755·6	10·38
" "	— " "		§1285·	5·49
Albert coal, N. B.	— " "		‖3016·37	11·78
Peytona cannel,	— " "		‖1440	8·4
Lesmahago cannel,	— " "		1529	8·77
Capeldrae,	— " "		1670	10·01
Donibristle,	— " "		1277·5	7·51
Wigan,	— " "		627·4	3·04
Pelton Main (caking)	— " "		532	3·12
Ramsay's (Newcastle),	— " "		558	3·33
Westmoreland, Pa.	— " "		‖541·25	3·32

The theoretical density of the gas obtained in this process is surprising, inasmuch as 1816 pounds avoirdupois of gas gives for each cubic foot of gas 926·72 grains. Now as 536·96 grains of air make one cubic foot, it follows that the density of the gas is 1·716, or nearly double the density of olefiant gas. Refrigerated at —6° F. this gas loses 41·8 per cent of its illuminating power, a loss not greater than we have found in common street gas at the same temperature.

The quantity of this material was represented by my informant as extremely abundant, adequate to any demand which might arise for it in commerce. I have taken steps, since discovering its remarkable technical value, to obtain more exact data respecting it. The masses which came under my observation resembled in appearance the finest varieties of English cannel, but differ in color and especially in streak as already described. Two of these masses weighed about one hundred pounds each, were prismatic in form and exhibited no structure, opposing an equal resistance to the hammer in all directions and breaking only with extreme difficulty.

The probabilities are that the material occurs in various degrees of purity, and that these may shade off by imperceptible degrees into each other, as is observed to be true of many cannel coals. It is therefore quite possible that the wollongongite may sometimes be found, on more extensive exploration, free to a greater degree of the contaminating 'ash,' and in that case we may expect to see it assuming a more or less transparent honey or wax yellow aspect, such as it now shows in thin shavings under the microscope.

I should remark that the illuminating power of the gas from the wollongongite was determined upon its *maximum* yield of nearly 14,000 cubic feet to the ton of 2240 lbs. Had the yield been restricted to 10,000 cubic feet it is quite probable its illuminatidg power would have been at least 150 candles for 5 cubic feet. This opinion is based on comparative results obtained with the albertite of New Brunswick. The maximum yield of gas from this latter remarkable material is per 2,240 pounds, 15,000 cubic feet with an illuminating power of 58·14 candles. But when the yield of gas is restricted to 10,000 cubic feet per ton of 2,246 pounds the illuminating power rises to 70·38 candles. The amount of coke left by one ton of albertite is 946 pounds, corresponding very closely to the results of analysis in a platinum crucible which show for 100 parts:

Volatile matter	57·0
Fixed carbon	42·5
Ash	0·5
	100·00

This ratio would require 963 pounds of coke, as near an approach as operations in the large way can be expected to give, being within 1·76 per cent. The quantity of sulphur in the albertite is less than in the wollongongite, the number of cubic feet of the gas from the former completely purified by one bushel of lime being 9025 against 5686 feet of the latter.

At —7° F. the gas from the albertite lost 34 per cent of its illuminating power.

I am indebted to J. A. Sabbaton, engineer of the Manhattan Gas Light Company, New York, for the facts here given as to the technical value of the albertite, being the results of a recent determination, called out by the remarkable facts furnished by the wollongongite.

New Haven, May 19, 1899.

June 3, 1869.—Since the foregoing was in press I have had an opportunity to test the value of the wollongongite, by the Hydro-carbon Gas Process, with the following results.

A mixture was made of 5 per cent of wollongongite with 95 per cent of bituminous (caking) coal of Westmoreland, Penn., the value of which coal when treated alone by the same process had been previously determined. Of this mixture four charges of 200 pounds each were employed, and the total yield of gas produced after purification, measured by the station meter. Also a mixture of 10 per cent wollongongite with 90 per cent of Westmoreland coal was prepared, and of this likewise four charges of 200 pounds each used; the gas produced being measured in the same manner.

The time of carbonization was in each case two hours, and during all the time the products from the anthracite retort (hydrogen and carbonic oxyd) were acting in full force on the distillation-products of the coal mixture.

[Professor S. here inserts the complete transcript of the record of the experiments, for which we must refer to the original.]

At the end of the second hour from the commencement of the last charge the operation was closed, giving an average product for each charge of 1470 cubic feet of gas, or a yield of 7·35 cubic feet for each pound of the mixture employed. As by former trials I had determined the value of the Westmoreland coal *alone*, by the Hydro-carbon Process, to be 6·57 cubic feet of gas, it follows that the increase of 1·08 cubic feet of gas is due to the average addition of 7½ per cent of the wollongongite

The yield of gas per one ton (2240 lbs.) of such a mixture would therefore be 16,464 cubic feet.

The Illuminating Power of the Gas.—The illuminating power of the gas in these experiments was determined by the Bunsen Photometer in the usual manner.

From the two first charges of 5 per cent of wollongongite and 95 per cent of Westmoreland coal the corrected result of 15 observations gave an illuminating power of 18·79 candles.

From the charges containing 10 per cent of wollongongite the illuminating power was 26·98 "

Average power for whole quantity containing an average of 7½ per cent of wollongongite, 22·88 "

These results are given for the usual standard of five cubic feet of gas burned in one hour in an Argand standard burner.

The total economical effect of a mixture containing ten per cent of wollongongite is best stated in the quantity of spermaceti, equivalent to one ton (2240 pounds) of such a material, which in this case is found to be 1774.9 lbs.

The Westmoreland coal alone when treated by the same process yields a total economical effect, 797·6 "

Gain of total economical effect due to the use of 10 per cent of Wollongongite, 977·3 "

Equivalent to 221 9-10 per cent gain.

As the yield of gas per ton of this mixture is 16464 c. f.

And Westmoreland coal alone by same treatment, 14057 "

It is evident that 7½ per cent of Wollongongite (or 168·2 lbs.) have yielded gas, 2407 "

This quantity (2407 ÷ 168·8) corresponds to 14·31 cubic feet of gas to the pound of material. When treated alone by the common process the wollongongite yields, as already stated in the former part of this paper, 6·11 cubic feet per pound. There in an increase therefore of 232 5-10 per cent in the volume of the gas obtained from the wollongongite under the influence of the hydro-carbon process. It is evident, therefore, that under the influence of this process the extremely

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* Mr. Young, of Glasgow, well known for his researches upon coal oils, of which industry he is a well known promoter, obtained the following results on the Wollongong cannel, by distillation for oil. The cannel yields per ton of crude oil, sp. gr. 0·860—152 gallons, divided as follows:

"Mineral turpentine" (light naphtha,)	Sp. Gr.—0·732—8 galls.	
Burning oil	" 0·815—72	"
Lubricating oil	" 0·890—33	"
Paraffin, 49 pounds		5 "
Loss, ash, etc		32 "
Total		152 "

Gas found by Mr. Young, 16,000 cubic feet per ton. Private communication by Mr. Hall.

* The standard candle in use among gas engineers consumes 120 grains of sperm per hour. The total economical value of any gas coal is best obtained by multiplying the candle power of the gas produced from one ton of the coal into the volume of the gas; thus as the Wollongongite yields 13,716 cubic feet of gas, *one* foot of which has an illuminating power of 26·54 candles, therefore we have 26·54 into 120 into 13716 ÷ 7000—6251·26 pounds of sperm as the value of the gas from one ton of this mineral.

† Advertisement of the proprietors. ‡ Dr. Fyfe.

§ Manhattan Company, *loc. cit.* ‖ Our own results.

dense and rich gas which the ordinary process returns from this coal is broken up into a much larger volume of gas, of a less density and lower illuminating power. Wollongongite has therefore the power to raise the illuminating intensity of gas from common caking coals when treated by the hydro-carbon process, even when so small a quantity as five per cent is employed, much above the average of illuminating gas in common use; while at the same time the volume of the gas produced, exceeds 16,400 cubic feet per ton against about 10,000 cubic feet by the common process, of a much lower illuminating power.—*Am. Jour. of Science, July*, 1869.

Ixtle Fiber.

In the monthly report of the Department of Agriculture for May and June, we find the following in reference to the Ixtle Fiber, which is said to form the best material for paper stock, and that several magnificant samples of paper, for banking and commercial purposes, have been made by manufacturos in the Eastern States:

A letter has been received by the Commissioner of Agriculture, dated Harlem, New York, from Hon. J. McLeod Murphy, accompanied with three skeins of the ixtle fiber, or *Bromelia sylvestris*, each produced from a single leaf, or which a single plant might average 20. A package of hackled fiber of the same material is received, and another containing small samples of fishing tackle, which may be seen in the museum of the department. The following is the substance of the communication:

First of all, before I describe the plant and the method of its cultivation, I beg to call your attention to the extraordinary *length* and *strength* of the individual fibers, their susceptibility of being divided almost infiinitessimally without breaking, their flexibility without *kinking*, and the readiness with which they received and hold vegetable or chemical dyes without being impaired. Since my return from Mexico I have had little or no opportunity of testing this plant practically; but some samples, such as I send you, were given to an old and experienced maker of fishing tackle, and he does not hesitate to pronounce the ixtle fiber as superior in every respect for the manufacture of trout and other fishing lines, not only on account of the readiness with which it can be spun, its extraordinary strength, but its perfect freedom from kinks when wet. The only secret if there is one, consists in the perliminary precaution of boiling the fiber (as you have it here) before twisting it, In this one respect it will supersede the use of silk.

Apart, however, from its use as a thread, I hazard nothing in saying that it forms the best paper stock that can be obtained. I speak now in reference to the imperfect, withered, rejected, and dried leaves, from which the fiber cannot be conveniently extracted by the indifferent mechanical means that the Indians employ. Although I have no samples of paper made from this source just now at hand, yet I can assure the department that several magnificant samples of paper for banking and commercial purposes have been made by manufactures in the eastern States, from the dried leaves of the ixtle plant brought from the neighborhood of Tabasco.

The srmples of fiber I send herewith were obtained by the most primitive means, viz., by beating, and at the same time scraping, the leaf of the plant (in a green state) wit a dull machete. Then, after the removal of the glutinous vegetable matter, it is combed out and rubbed between the knuckles of the hand until the fibers are separate. The next step is to wash it in tepid water and bleach the skeins on the grass. Tnis is the method pursued by the Indians on the isthmus of Tehuantepec; and the average product for the labor of a man is from four to five pounds per day.

1t is scarcely necessary to tell one so well informed as yourself that this spontaneous product is the *Bromelia sylvestris*, which differs in some respect from the *Agave Americana*, the *palque de maguay*, and *Agave sisalana* of Campche; a difference arising solely from soil and climatic influences. The name *ixtle* is given to that species whsch is characterized by the production of the long fiber; and chiefly because the leaf, being shaped like a sword, has its edges armed with prickles, similar, in fact, to the weapon formed from *itzli*, or obsidian, used by the Aztecs. Hence the term. The *pita* on the other hand, although obtained from a variety of the same plant, is a coarser and shorter fiber, which grows in the *tiarras templadas*. The name comes from the word *pittes*, which is given to the plantations of the pulque plant in the uplands of Mexico. But the peculiarity of the ixtle is that it grows almost exclusively on the *southern* shore of the Mexican gulf, or in what is known as the "sota vento," that is to say, between Alvarado and Tabasca, and extending as far inland as the northern slopes of the dividing ridge which separates the Atlatic from the Pacific. The points generally selected for its cultivation are the edges of a thick forest, for which the small undergrowth is removed by cutting and burning. The roots of the plant are then set out at a distance of five or six feet apart; and at tho end of a year the leaves are cut and "scraped." The chief object is to obtain constant shelter from the rays of the sun, which would otherwise absorb the moisture and so gum the fibers together as to make them inseparable.

The average length of the leaf is six feet, and the time to cut them it is clearly indicative by the upward inclination it makes. In other words, the radical leaves cease to form curved lines with their points downward but stiffen themselves out at an angle as if to guard the source of efflorescence. When the ixtle is young its fibers are fine and white, and as it grows in age they become longer and coarser; and in a wild state the thorns are numerous, but by cultivation they are diminished both in size and number, and in many instances there are none at all. When any quantity of leaves require to be handled, a pitchfork would be very useful especially if gathered for paper stock. A few days after cutting the sun would dry them out, the thorns would drop off, and then they could be easily baled. Independent of the great value which the ixtle has for textile fabrics and for paper, it posesses many valuable tmedicinal properties, to which I need not allude. I requires no labor to cultivate it, and no insect is known to feed upon it. It grows everywhere in the primeval forests of the Gulf coasts, and, in my opinion, is far superior to any of the grasses for textile fabrics. But as yet no mechanic has succeeded in devising a means of effectually extracting the fiber, and until this is done I presume that its real commercial value will remain unappreciated.

You will readily discover the superiority of the ixtle over the *jenequin* of Cuba, or the hemp which comes from Sisal and Campeche.

Protected Nitro-Glycerine.

The recent lamentable results attending the transit of this useful, but dangerous, blasting material sufficiently demonstrate the enormous practical value of any preparation that shall ensure its safe conveyance and storage; and, jndging from the experiments made a few days since by Dr. Comyn, at the East Mid-Wales and the Mid-Wales Mines, this desirable end has been successfully accomplished by Mr. Horsley's patent protected nitro-glycerine. To prove that it will not ignite or explode even on the application of fire or heat, a quantity of the blasting-oil, as "protected" by Mr. Horsley, was placed in a chip-box; the latter was burned away, while the nitro-glycerine remained unexploded; and to show that it cannot be exploded by violent concussion, the same compound was subjected to several blows on an anvil, the result being, as in the former case, that the oil remained perfectly inert. Another experiment proved that, while the nitro-glycerine thus "protected" can be removed from place to place with perfect safety, the "protection" can be easily removed leaving the blasting properties of this valuable oil entirely unchanged. This was shown by placing the "protected" oil which had been used in the two previous experiments in a vessel of warm water. By this simple process the protecting substance was dissolved, and the nitro-glycerine employed as a blasting agent, when the result abundantly proved that its properties had remained intact. The efficacy of the preparation has been demonstrated among others by Mr. Isaac Lowthian Bell, F.C.S, (of Newcastle-on-Tyne), who states that the nitro-glycerine is rendered so inexplosive that a blow, sufficient to fire dynamite had no effect upon it, nor did exposure on a red-hot bar of iron produce any apparent combustion. A small quantity of the inexplosive nitro-glycerine, freed from the presence of the matter which rendered it harmless, was placed on a piece of boiler-plate, ¾ in. thick, and fired with a fuse. The explosion was so violent that it fractured the wrought-iron. Mr. W. Francis, of the Penrhyn Quarries, has also testified to the merits of the invention by stating that the experiments with Mr. Horsley's protected nitro-glycerine was perfectly successful; it did not explode when being struck with a large sledge-hammer on an anvil, nor explode upon a quantity of it being placed in a smithy. The oil was then extracted from the compound and fired in the usual way, with a percussion-cap, and the usual result followed. Some further important experiments were made with Mr. Horsley's patent blasting-powder, the properties of which, according to the practical testimony of the miners before whom the trials were made, most favorably compared with ordinary gunpowder.—*London Mining Journal, July 24th.*

Society of Practical Engineering.

The New York Society of Practical Engineering met on Wednesday afternoon, the 18th ult., at room No. 14, No. 95 Liberty street. for the election of officers and transaction of business relative to the coming session. The election resulted as follows: President, James A. Whitney; VicePresident, Joseph B. Lyman; Recording Secretary, Lawrence Holmes; Treasurer, C. Williams.

A vote of thanks to the Trustees of the Cooper Institute was passed unanimously, they having offered the Society the use, without charge, of a room for the meetings. The offer was accepted, and the meetings will be held monthly in one of the rooms of the Institute buildings. A resolution was also adopted inviting both graduates and students of the Cooper Union to participate in the meetings; also one providing that the graduates be privileged for admission to membership without the payment of an admission fee. A resolution was also carried by acclamation, extending an invitation to the President of Columbia College and the Faculty and students of the School of Mines to be present and assist in the discusions, etc., of the stated meetings.

It was decided to hold the opening meeting of the next session on Wednesday evening, Sept. 15. The regular subject will be, "the Uses and Construction of Water Meters." A carefully prepared paper giving much information new to the public will be read, and the report of a committee appointed some months ago to investigate and compare the most noted water meter will be rendered. Any inventor or manufacturer of water meters will be allowed after the reading of the above, to exhibit and explain his improvement, provided that he have either a working model or full-sized apparatus to illustrate his remarks. It is hoped that a full exhibition of the novelties in this important class of mechanism will be had. The meetings will, as hitherto, be free to the public. It should be mentioned that among the other resolutions adopted, reducing the fee on the admission of members from $10 to $3 and the annual dues from $10 to $2.

Opening of the Suez Canal.—The programme for the opening of the Suez Canal, on the 17th, 18th, 19th, and 20th November, is now settled. All merchant ships or vessels of war arriving at Port Said or Suez during these days will be allowed to pass through free of all dues. From the 21st the charge will be according to the terms of the concession, 10 f. (8s.) for every passenger, *and for every ton, according to the legal measurement of every flag.* The last clause seems a little ambiguous, as there are great varieties of tons, and the ships of some countries may thus be compelled to pay more than others. The matter is one which the Board of Trade and Foreign Office should see to on behalf of English shipping, so as to prevent any inequality. It is difficult for a private company to settle such matters without giving rise to controversy, but they should be able to do so with the assistance of an impartial board representing the governments interested.—*Morgan's Brit. Trade Jour. Aug.* 2.

The Darien Canal.—Mr. Cullen, M.D., writes as follows:—The Pacific Railroad being completed, and the Suez Canal likely to be soon open for traffic, the junction of the Atlantic and Pacific by a ship canal across the Isthmus of Darien is the next great work to be executed, and must now take its turn as a matter of course. It is time, then, that the attention of capitalists and engineers should be directed to this project and that a detailed survey should be made of the line, for the future canal, which is only 39 English miles in length. This line has, at the Atlantic terminus, Caledonia Harbor and the Channel of Sassardi, and at its Pacific terminus, the Estuary of the Savana and Tuyra rivers, and the Gulf of San Miguel, all those harbors being perfectly secure, and admirably adapted for the entrances of a grand inner-oceanic canal. The ground is of moderate elevation, and presents no difficulties which the ordinary resources of engineering science may not readily overcome. As one engineer with four assistance complete the survey in a few months, it is to be hoped that immediate steps will be taken to commence this necessary work.

Correspondence.

[Correspondents in all cases should sign their communications with their names and address in full, not necessarily for publication, but as a guarantee of good faith.—EDS.]

[We take pleasure in publishing this, as one of the many letters, showing what our readers think of the Journal.—EDS.]

Complimentary.

SAGINAW, MICH., Aug. 16, 1869.

Messrs. Editors: I have your reply and receipt, and two numbers of the Journal for June. Have learned that our copies have been received at the Gas Office in East Saginaw, and destroyed. As yet we are lacking the numbers issued for July and August, which you will please mail to my address, as well all of the future copies. We esteem the Journal as a valuable addition to our counting room, and desire to preserve each number, and have them bound, "and give them a place among the archives of the Company." Have received "Clegg," and return thanks for your trouble.

Yours very truly,

N. CAMERON,

Sup't Saginaw Gas-Light Co.

List of Examiners now in the Patent Office.

The following list embraces all the Examiners-in-chief and Principal Examiners now in the Patent Office, with the class or classes of inventions of which each principal Fxaminer has charge. The Examiners-in-chief have no porticular classes assigned to them, but act nominally as a board:

EXAMINERS-IN-CHIEF:

S. H. Hodges, S. C. Fessenden, R. L. B. Clark.

PRINCIPAL EXAMINERS:

Name. *Class.*

Thomas R. Peal..Fine Arts and Sports, Games and Toys.
Wm. B. Taylor....Philosophical Instruments.
J. W. Jayne.....Machines and Tools for Cutting and Shaping Metal.
B. S. Hedrick.....Chemical Compositions-in-matter and Metallurgy; Paper.
J. Brainard.....Agriculture.
Joseph T. Fales.....Household Furniture.
T. C. Connolly.....Hydraulics and Pneumatics.
A. Schoepf.....Land Carriages: Mechanical Movements.
J. M. Thatchor....."Interferences."
L. Deane.....Calorifice.
D. S. Stewart.....Printing and Stationery; Electricity.
Geo. W. Gregory...Sewing Machines; Weaving and Spining.
A. G. Wilkinson.....Builders' Hardware; Surgical Apparatus.
Chas. Everett.....Fire-arms; Navigation.
Ellis Spear.....Civil and Railroad Engineers; Architecture.
T. A. Cook.....Steam and Air Engines, Boilers, etc., etc.
J. C. Tasker.....Wood-working
Geo. A. Nolen.....Harvesters.
C. M. Parks.....Leather and Harness; Glass Manufactures; Stone-working.
T. C. Folger.....Clay Manufactures; Grinding Mills and presses.
H. T. Munsen.....Finishing Textile Fabrics, Wearing Apparel, Felting and Hatmaking, Fruit Jars.
Emmett Quinn.....Manufactured Articles of Metal.

Combustion Under Pressure.—M. Deville, before the French Academy, takes ground in opposition to Dr. Frankland's views on the cause of luminosity in a flame. The latter physicist held that the cause of luminosity is the density of the atmosphere, citing in proof that the flame of pure hydrogen, while barely discernible at the ordinary pressure of the air, becomes more and more luminous as the atmosphere around it is compressed. M. Deville explains this by showing pressure to be elevation of temperature, and luminosity to be dependent on temperature. He suggests that engine furnaces be supplied with air under pressure, in which case the products of combustion slowly pass through the tubes of a much higher temperature than ordinarily, and the heating efficiency may be greatly increased. The application of this idea, he thinks, may be made particularly valuable in the case of marine boilers heated with liquid hydro-carbons.

An American Atlantic Telegraph.

The New York *Times* states that a number of wealthy and skilled financiers have for some time past, been quietly working up the means and the programme for an American Atlantic cable, to proceed direct from New York city to Europe. This line will be worked with what are known as "sounder instruments"—that is, the alphabet is indicated by sound instead of by the galvanometer reflector system, as now used on cables, and can be operated three or four times as rapidly as can possibly be done by the present system. Two sets of these instruments were manufactured for this company some time since, and have been thoroughly tested both in Europe and America—in Europe through a circuit of 3,000 miles of insulated wire, and with the most perfect success. They are constructed upon entirely new principles, and are so far wholly unknown to the public. It is confidently expected that the project will be far advanced toward completion this fall. For prudential reasons the European terminus of the American cable is for the present withheld; but it is perhaps worth while to mention that the consideration of amity, present and prospective, of any foreign government haa entered into the calculation of the new projectors in the selection of a terminus. It is expected, indeed it is intended, that by constructing a direct line from New York city, and working it upon these plans, the company will be enabled to do business at rates scarcely, if at all, in advance of present rates on American land lines.

New Process of Gas Manufactnre.—We notice through the London *Builder* of August 14th, that a new gas-making machine has been patented by Mr. Geo. Flintoff, gas engineer, which, if it fulfils expectations, is likely to be attended with important results. The machine, which is portable in the smaller sizes, may be made of any size, and is adapted for use in houses, shops, churches, theatres, or other public buildings, or ships. The machine is simple—a cylinder fixed within another of larger size is charged with rock oil; provision is made for the oil to trickle from the resorvoir to the bottom of the space between the outer skin of the machine and the cylinder. The bottom of this space is filled with wool, which absorbs the oil as discharged. When gas is drawn off from the machine, a piece of clock work apparatus on the top of the machine is put in motion, and pumps in the atmospheric air proportionately to the consumption or discharge of gas. The mixture of atmospheric air and oil vapor constitutes the inflammable gas. Any number of burners may be supplied from the machine in the same way as from an ordinary meter, and the pressure regulated at the "main," that is, the discharge-pipe from the machine, and at each burner, in the usual way. The cost of the gas thus produced cannot, at this early stage of the invention be accurately stated, but a computation has been made that a gallon of rock oil, costing 2s. 6d., will make 1000 cubic feet of gas of 14 to 15 candle illuminating power.

Coal and Iron in the Unlted States

About 28 miles of the track of the New York and New Haven Railroad were relaid last year with steel rails. About 2800 tons of steel rails have been ordered for the renewal of the track during the present season: when these are all placed in the track, about one half the entire road will be laid with steel. The rails, etc., required for the whole of the Iowa Falls and Sioux City Railroad have been purchased, and the quantity needed for 33 miles of the line has been shipped. The Alabama and Chattanooga Railroad will, it is said, develop inexhaustible coal fields, of a quality superior to any yet discovered south of the Ohio; it is also expected to open out vast deposits of hematite iron ore. The plans of Mr. Kneass have been adopted for an iron bridge over the Schuylkill, at South-street. Philadelphia; the centre and river piles will be of iron, sunk by the pheumatic process; the length of the bridge will be 2488 ft., and the clear height 32 ft. above high water. Reports from Lake Superior state that the production of iron in that district has been larger than ever this year. The Keystone Bridge Company, of Pittsburg, has contracted to a wrought iron bridge on the Boston, Hartford, and Erie road, at Tiddleton, Connecticut; the bridge will be 1200 ft. long.

New Mode of Laying and Jointing Pipes.

A patent joint, says the London *Builder* of July 17, has been invented by Mr. William Williams, an active member of the Water Committee of the Town Council of Liverpool. It consists simply in the direct contact or union of a cylindrical socketed with a spherical butt-ended pipe, without the intervention or use of lead or packing of any kind. The socket end of each cast-iron pipe is made of thickness uniform with the pipe itself, and strengthened by an external hoop of wrought iron. It is then correctly bored so as to form a true section of a cylinder. Upon the butt-end of the pipe is cast a projecting boss or ring, the surface of which is turned truly so as to form the zone of a sphere, of external diameter equal and duly proportioned to the internal diameter of the cylinder. The union of the two metal surfaces is thus designed to be perfectly maintained throughout a circular ring or line of conduct which within the cylinder is fixed, but varies on the spherical zone, according to the angle of direction at which the pipes are united, while the tightness of the joint is unimpaired by change of position. It is therefore a movable joint, so that, within certain limits, the line of direction of the pipes may be changed, and in case of disturbance or subsidence of the ground in which they are laid, the line of pipes is self-adjusting, and the distortion is unaccompanied by fracture or leakage. It is proposed to use these pipes within the Hilton House Tunnel of the Rivington Pipe Line, where settlement is apprehended from the working of the seams of coal beneath, and a saving of £30,000 is expected to result. The invention has been tested in presence of the mayor and corporation, and various architects, engineers and others interested.

Hints to Inventors—False Economy.

It is false economy, says the *American Artisan*, on the part of an inventor to delay reducing his invention to a tangible form, through fear of incurring a necessary first expense or outlay, which may be inconvenient to him at present. By such delay he not only runs the risk of being forestalled by others, but postpones whatever emolument may be derivable from his discovery, and so generally loses more than he saves or hoards by delay. Again, it is false economy to defer patenting an invention, any longer than is necessary to enable him to reduce it to a practical form, with the hope of making further improvements, inasmuch as in inventions of any value, it is almost invariably the case that one leading feature forms the foundation of the patent, and this being secured, he may, without the same danger of being anticipated, bestow as much afterthought on the minor features as may make them perfect enough to satisfy him. The period that usually elapses between the filing of his application for a patent and its examination, with the whole or a portion of the six months during which, if he chooses, he can afterwards suspend the issue of the patent, generally affords ample time for maturing details; and if it be of sufficient importance to patent these at all, it is generally better, and often more profitable, to make them the subject of a second patent. By this course the risk of being anticipated by others on what is the primary ground of the invention is avoided.

The Zirconia Light.—The oxyhydrogen light has been such a success at the Tuilleries, having been worked without interruption since the 21st of January, that the Emperor has ordered measures to be taken to render that mode of illumination permanent in front of his palace. During the interval required for getting these new arrangements ready, the court will be lit up with ordinary gas as before. In connection with this fact, M. Tessie du Mothay has had the Order of Chevalier of the Legion of Honor bestowed upon him, and well has he merited it, for his many useful and practical inventions. Whether the process introdnced by this gentleman for the commercial manufacture of oxygen from the manganates is the best that can be used for the purpose, may, perhaps, be open to discussion; this, at any rate, is true, that it is the only process that has succeeded on a large practical scale up to the present time.—*Brit. Journal of Photography.*

Tyndall on Light.

Dr. Tyndall, the accomplished successor of Faraday, has recently concluded a brilliant course of lectures on light. One of the series introduced the interesting subject of double refraction. As many of our readers are daily observers of the phenomena of double refraction, and as it is a subject illy understood, we will append the learned professor's remarks and illustrations thereon. In air, water, or well-annealed glass, the luminiferous ether possesses the same elasticity in all directions. There is nothing in the molecular grouping of these substances to interfere with the perfect homogeneity of ether. But, when water crystalizes to ice, the cause is different; here the molecules are constrained by their proper forces to arrange themselves in a certain determinate manner. They are, for example, closer together in some directions than others. This arrangement of the molecules carries along with it an arrangement of the surrounding ether, which causes it to possess different degrees of elasticity in different directions. In a plate of ice, for example, the elasticity of the ether in a direction perpendicular to the surface of freezing is different from its elasticity in a direction parelled to the same surface.

This difference is displayed in a peculiar striking manner by Iceland spar, which is crystalized carbonate of lime; and in consequence of the existance of these two different elasticities a wave of light passing through the spar is divided into two; the one rapid, corresponding to the greater elasticity and the other, slow, corresponding to the lesser elasticity. Where velocity is greatest, the refraction is least, and *vice versa*. Hence in Iceland spar,as we have two moving waves with different velocities, we have double refraction. This is also true of the greater number of crystalline bodies. If the grouping of the molecules be not in all directions alike, the ether will not be in all directions equally elastic, and double refraction will be the result. In rock-salt, alum, and other crystals, this homogeneous grouping of the molecules actually occurrs, and such crystals behave like glass, water, or air. In certain doubly refracting crystles the molecules are arranged in the same manner on all sides of a certain direction. For example, in the case of ice, the molecules arrangement is the same all round the perpendiculars to the surface of the freezing. In like manner, in Iceland spar the molecules are arranged symmetrically around the crystallographic axis, that is, around the shortest diagonal of the rhomb into which the crystals may be cloven. When a beam of light passes through ice perpendicularly to the surface of freezing, or through Iceland parallel to the crystallographic axis, there is no double refraction. These cases are representative; that is to say, there is no double refraction in the direction around which the molecules arrangement is in all directions the same. This direction of no double refractisn is called the optic axis of the crystal.

The vibrations of the ether being transverse to the direction of the ray, the elasticity which determine the rapidity of transmission is that at right angles to the ray's direction. In Iceland spar, the velocity is slowest in the direction of the axis; hence, the elasticity at right angles to the axis is a minimum.

The ray on the other hand, whose vibrations are executed along the axis is the most rapid; hence, the elasticity of the ether along the axis is a maximum. In perfectly homogeneous bodies, the surface of elasticity would be spherical; it would be measured by the same length of radius in all directions.

In the case of Iceland spar, the surface of elasticity is an ellipsoid whose longer axis coincides with the axis of the crystal. The two beams into which the incident beam is divided by Iceland spar, do not behave alike. One of them obeys the ordinary law of refraction; its index of refraction is perfectly constant, and independent of its direction through the crystal.

The angles of incidence and refraction are on the same plane, as in the case of ordinary refraction. The ray which behaves thus is called the ordinary ray. In its case, the sine of the angle of incidence is to the sine of the angle of refraction, or the velocity of light in air is to its velocity in the crystal, in the constant ratio of 1.654 to 1. The number 1.654 is the ordinary index of Ic land spar.

But the other beam acts differently. Its index of refraction is not constant, nor is the angle of refraction, as a general rule, in the same plane as a the angle of incidence. The ray which behave thus is called the extraordinary ray. If a prism be formed of the spar with its refracting angle parelled to the optic axis, when the incident beam traverses the prism at right angles to the optic axis, the separation of its true parts is a maximum.

Here the full difference of elasticity, between the axial direction and that perpendicular to it, comes into play, and the extraordinary suffers its mimimum retardation, and therefore its mimimum refraction. Its refractive index is then 1.483.

The index of refraction of the extraordinary ray varies with its direction through the crystal from 1.483 to 1.654. The minimum value of the ratio of the two sines, or of the two velocities namely, 1.483, is called the extraordinary index. When a small aperture through which light passes is regarded through the rhomb of Iceland spar, two apertures are seen. If the rhomb be placed over a black dot, two dots will be seen, and if the spar be turned, one of the images of the dot will revolve around the other. The rotating image is that formed by the extraordinary ray. With bisulphide of carbon the shallowness would be more pronounced, because the refraction is greater.

In 1808, Malus, while looking through a double refracting prism at one of the windows of the Luxembourg Palace, in Paris, from which solar light was reflected, found that in a certain position of the spar the ordinary image of the window almost wholly disappeared.

He immediately came to the conclusion that some new property was impressed upon the light by its reflection from glass. What is this property? It may be most simply studied and understood by means of the crystal tourmaline. This crystal is bi-refractive; it divides a beam of light incident upon it into two, but its molecular grouping, and the conseqnent disposition of the other within it, are such that one of these beams is rapidly quenched, while the other is transmitted with comparative freedom. It is to be borne in mind that the motions of the individual ether particles are transverse to the direction in which the light is propagated. In a beam of ordinary light, the refractions occur in all directions round the line of propagation. The change suffered by light, in passing through a plate of tourmaline of sufficient thickness, and cut parellel to the axis, is this; all vibrations, save those executed parellel to the axis, are quenched within the crystal. Hence, the emergent from the plate of tourmaline has all its vibrations reduced to a single plane. In this condition it is a beam of polarized light.

With regard to polarization by reflection, the polarizing angle augments with the refractive index of the medium. For water it is fifty-three degrees; for glass, fifty-eight degrees; and for a diamond, sixty-eight degrees.

Thus, a beam of ordinary light, whose vibrations are executed in all directions, impinging upon a plate of glass at the polarizing angle, is, after reflecting all its vibrations, reduced to a common plane. The direction of the vibrations of the polarized beam is parellel to the polarizing surface.

In a certain position, light is freely transmitted through a tourmaline plate, while in the perpendicular position it is completely stopped. This proves the beam emergent to be polarized.

Experiments upon Sounding Flames.

A. Weinhold, of Chemunitz, recommends a very simple contrivance, to obtain flames of great sensitiveness to tones or noise, with ease and certainty. A pressure of at least an inch and two-tenths of water is necessary to the production of a sensitive flame, and as this cannot always be had, a gasometer can be contrived out of a bell jar suspended by a cord running over a pulley with a scale pan attached to the end for weights, with which to regulate the pressure. The bell jar can be dipped into a large vessel, and filled wirh gas by syphon. A three gallon jar will furnish sufficient gas for more than a minute, and can easily be replenished. Weinhold recommends certain precautions:

"The flow of gas must be through capacious tubes so that the pressure cannot be diminished near the burner. A half-inch tube is necessary if the pressure does not exceed one and a quarter inches. The india-rubber tubes must also be capacious. The gas where it flows out must not make the least noise. Such an effect is sometimes produced by the roughness in the sides of old tubes or imperfection in the stop cocks. The burner must be a simple hole with a wide opening a sharp angle and smooth sides. Glass tubes drawn out to five-hundredths of an inch in diameter serve a good purpose. A cylinderical piece of soap-stone serves better than glass, as it is not liable to crack. The best results are obtained with a burner the inner diameter of which at the point of ignition is 0.08 of an inch, and in a length of one inch widens to two-tenths of an inch. Such a burner consumes 19 cubic feet of gas per hour, and gives the flame 19 to 23 inches in length. At every noise the flame shortens and divides itself into two distinctly separable parts—the lower, cylinderical, quiet—the upper, wide, illuminating and rustling.

"By uttering hissing consonants, the flame is shortened one-half: OO in deep tones has no effect; A and Ae act powerfully. The rustling of tearing of a piece of paper, the striking together of two pieces of glass, the ring of a bundle of keys, the ticking of a watch, all produce a marked drawing together of the flame. A shrill whistle causes the flame to assume a swallow-tail shape."

MISCELLANEA.

Water Supply for Jerusalem.—It is said that Miss Burdett Coutts has taken on herself the entire expense of introducing pure water into Jerusalem.

Pacific Railroad.—The passenger travel on the Pacific Railroad continues very heavy. Pullman is running two and sometimes three palace sleeping cars on each train, which are always full.

There is a spring of clear, cool, sweet water in the mine of the James River Cement Works, Virginia, the use of which has cured several cases of chronic dysentery of twelve months' standing. The workmen who use it are never troubled with this usual complaint of miners.

Prof. Marsh, of Yale College, has discovered in the tertiary deposits of Nebraska, the minutest fossil horse yet obtained. It is only two feet high, although full grown. This makes the seventeenth species of fossil horse discovered on this continent.

Inverted Syphon.—An iron pipe, eleven inches in diameter and 8,800 feet (one and two-third miles) long, has been laid in Tuolumne county, California. It runs down a mountain, under a creek, and up the ascent on the opposite side, under a perpendicular pressure at the lowest point of 683 feet.

Exports of Coal.—By the monthly circular for May, of Messrs. Higginson, Liverpool, we learn that the quantity of coal exported in April was 860,851 tons, against 933,515 tons in the corresponding month of 1868, showing a decrease of 52,564 tons.

A boring machine, to be used in prospecting for quarries, is soon to be brought into use in Hydeville. It enters a circle like the rim of a wheel, to the depth of hundreds of feet, leaving the inner portion undisturbed. At any depth a segment of the core can be lifted out, showing the rock formations, and saving thousands of dollars otherwise spent in excavating.

The new rolling mill at Rome, Ga., which is now building, will be the most extensive one in the State, and far exceed any in the entire South. Its length is 250 feet, and width 160 feet, with a wing half the size of the main building, and it will be run by six large engines.

Discoveries at Herculaneum.—The *Giornale di Napoli* mentions the discovery of a large room, which must have served for a kitchen. In it was a wooden clothes-press, entirely carbonized; also fourteen vases, a candelabrum and a lamp, all in bronze, several vessels in glass and terra-cotta; a small marble statue of a Faun, and two broken tables, one in marble and the other in slate.

A Uniform Source of Light.—For the purpose of experimentation on the measurement of luminous intensity, Mr. Crookes used, as a uniform source of light, a glass lamp containing a mixture of five volumes of alcohol, and one volume of benzol. The wick consisted of fifty-two pieces of platinum wire of 0.01 inch diameter. The flame burns at the uniform rate of 136 grains per hour.

Water Wheels.—The usual velocity of the periphery of overshot and high breast wheels is from three to six feet per second; and their available efficiency when well designed and constructnd, is from 0·7 to 0·8 of the total power of the fall. The diameter of an overshot wheel must be a little less than the height of fall of the water, and that of a high breast wheel some what greater.

Water a Luxury.—We learn from the *Austin Reveille* that the scarcity of water at Treasure City, in White Pine district, Nevada, renders it a costly luxury, in which none but the most favored may indulge. Only think of water at "eighty cents a gallon!" about $2 a bucket. We fancy it would be a relief to a denizen of Treasure City to "kick the bucket." The following notice appears in the White Pine *News* of the 8th ult.: "Treasure City Water Company—Standart, Page & Co. will supply the citizens of Treasure City daily with fresh, clear spring water at eighty cents per gallon." Would it not "pay" some enterprising owner of a water fountain between Austin and White Pine to run a line of water wagons to Treasure City? There must be a fine profit-margin from Zero to eighty cents.

Recent American Patents.

Pertaining to Gas, Water. Etc.

91,812.—Lamp-light Extinguisher.—James M. Aubrey, Portage City, Wis.

91 869.—Steam-Generator.—William K. Rhodes, Portland, Maine.

91,943.—Water-elevator.—Christian Henry Kock Davenport, Iowa.

92,067.—Water-elevator.—Zephaniah Lockwood, Saratoga Springs, N. Y.

92,087.—Turbine Waper-wheel.—Jas. Newman, Portland, Mich.

92,105.—Manufacture of Vapor-gas.—Chas A. Seely, New York City. Ante-dated April 10, 1869.

92,510.—Turbine Water-wheel.—Jeremiah Barney, Perry's Mills, N. Y.

92,537.—Vapor-burner.—Joseph H. Melick, New Germantown, N. J.

92,564.—Low-water Indicator.—Frederick S. Barns, New York City.

92,603.—Turbine Water-wheel.—Mahlon Gregg, Rochester, N. Y.

92,622.—Steam Water-heater.—William B. Mack, Detroit, Mich.

92,635.—Carburettor for Air and Gas.—William J. Nichols, Buffalo, N. Y.

92,687.—Steam Petroleum Gas-generating Apparatus.—Rodney M. Whipple and Augustin L. Ambler, Chicago, Ill.

92,691.—Fluid Meter.—Phinehas Ball and Benaiah Fitts, Worcester, Mass.

92,771.—Lamp burner.—Thomas Adams, Hudson City, N. J., assignor to Mary A. Van Alen, Brooklyn, N. Y.

92,842.—Rotary Pump.—A. H. Knapp, Needham, Mass. Ante-dated July 17, 1869.

92,892.—Hydrogen Generator and Carbureter.—Byron Sloper, St. Louis, Mo.

93,661.—Vapor-burner.—Joshua E. Ambrose, Lombard, Ill.

93,674.—Vapor-burner.—Lassle Chandor, assignor to Cassius M. Clay, St. Petersburg, Russia.

93,698.—Vapor-burner.—Thomas S. Gates and Alexander H. Fritchey, Columbus, Ohio.

93,739.—Process for purifying Paraffine.—C. Chauncey Parsons, New York City.

93,745.—Steam-generator.—Jonathan Quipp and Robert Law, Buffalo, N. Y.

93,790.—Feed-water Heater.—Peter C. Wortman, Meadville, Pa.

93,884.—Steam Water-guage Indicator for Boilers.—William Hodgson, Cincinnati, Ohio.

Prices of Gas Coals—Sept. 2.

PROVINCIAL.

Duty, $1 25	Coarse. Gold.	Slack. Gold.
Block House	$1 75	$0 75
Gowrie	1 75	0 75
Lingan	1 75	0 75
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Little Glace Bay	1 50	1 00
Caledonia	1 50	0 75
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Despard Coal Co.	8 50	8 00
Penn	0 00	0 00
Newburgh Orrel Gas.	8 50	8 00
West Fairmount Gas Coal		8 00
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PROFESSOR HENRY WURTZ.

[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

MONDAY, SEPTEMBER 2, 1869.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of those subjects a pleasure, or a profession.

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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, AT SALEM, MASS.

A certain British contemporary, of the Popular Scientific Press, may doubtless be struck with astonishment to hear that a recent editorial notice by him of the proceedings of the Chicago meeting of our Association, intended evidently on his part to be a patronizing pat on the head, gave umbrage deep and wide to his American readers. The notice alluded to begins thus: "It will be new to some of our readers to hear that there exists an American Association for the Advancement of Science, corresponding to our British Association, and that the meeting which is chronicled in the work we are about to discuss is the sixteenth meeting of that Association. The institution and support of such an Association indicates a zeal for Science among our American brethren which is surely a good omen, and a healthy sign of the times" *et præterea multa.*

Some of the aforesaid American readers might not find it altogether easy to define their reasons for the feeling excited by this. Let us try whether *we* can do so. American scientists are not free as a general thing from the weaknesses of mankind, such, fortunately, as patriotism for example, and appreciate their country, even though the feeling may not be reciprocated by the latter. The British lion never was pleased that we know of, when his fur was stroked against the grain, and the American eagle is quite as fiercely irritable and jealous about her feathers. *Timeo Danaos et dona ferentes.* A long and cumulative past experience, on the part of the so-called "American brethren," as regards recognition of their scientific *existence* (not to speak of any poor discoveries to which they may have had the temerity to advance claims, with provoking, though unnoticed pertinacity), tends to engender doubt in a case of such sudden and pointed patronage.

The first few words of the passage quoted are pointed to as treacherously betraying the necessity on the writer's part, at the outset of an article of so unusual a purport, of conciliating the mass of his older readers, or throwing a sop to Cerberus, so to speak.

Sad as it may seem, some have even gone so far in this case, as to recall an expression of a common ancestor of the "brethren," something about "the thrift that follows fawning."

Of course we are not to be understood as conveying these as our own proper views; for in verity we regret that they should have been held by those with whom we have conferred on the subject; our reason being that they have been thus led to pass over and reject the further consideration and the real significance of this editorial in the London *Chemical News.* We prefer to look upon it as a straw which shows the way the wind blows, as looking to a cosmopolitan acknowledgment which is soon to arrive, of the achievements of American science, an acknowledgment which is sure to react, in a most salutary way, upon American Scientists themselves; being indeed, in view of the peculiarities of American society, the one thing needful; as it will induce, by force of example, the masses of our own people to acknowledge and appreciate such of these leaders in the march of civilization as pertain to, and dwell among, themselves.

Our substantial topic is the meeting during last week and the week before, of our great Association at Salem, Massachusetts; the fourth meeting since the hiatus in its history caused by the war; and we will first tarry for a space to glance at the significant import of this hiatus. It shows the pre-eminently democratic and especially the *national* character of the organization of the Association. When our body politic was convulsed by internal troubles, most other national organizations, political, military, religious, and the like, marched on with surprisingly small interruption, dividing merely into two for the time; but the American Association received a check. *It could not divide.* Science could not recognize the petty political differences of men, however grand their effects on the destinies of nations, as worthy to influence her progress or her organic laws. At the mercy of events, however, she must wait, until circumstances should be so shaped by a higher power, that the working out of her own high destiny should again come under those laws which were seen to be inevitable.

Indeed, we believe true Science is *or should be*, of all things on earth, the most completely *democratic.* Her service should be one wherein all start on strictly equal terms, and wherein real service in the ranks, that is in the cause of Truth and of Humanity, should be the only claim to promotion. Hence two adaptations peculiar as between the American people and the American Association; and hence doubtless one of the especial attractions of this Association for the scientific youth of this land. Hence, we may add, the magnificent, inevitable and indubitable Future of the Association. The Genius of the Land, hand-in-hand with the Spirit of the Age, watch over it, and will keep it true to itself in the long run. Errors and abuses will creep in but will rectify themselves in time.

From our views, as here expressed, of the character, scope, mission and destiny of the Association, it will be apparent that we cannot join with those who still approve of the movement that was brought into effect during the cessation of its annual meetings, to merge an important portion of its elements into another Society, from which the democratic features were eliminated; and nothing connected with the recent very successful meeting at Salem gave us more pleasure, than to perceive that this new and exclusive organization has not been successful in detaching permanently from the Association some of its most highly prized and oldest members. In fact, a feature of the Salem meeting was the return to the ranks, for the first time, and the hearty cooperation, of a number of the veterans. Nor were we of those who were disgruntled by the reinstatement of the deserters, these prodigal sons, at once to their old rank and position in the Association. It *could not be otherwise*, and it is only to be hoped that *all* will in due time come back, and that all may go on just as before the war. It is clear, in any case, that the arguments which chiefly led to the institution of the Academy (namely, those directed against the lack of exclusiveness on the part of the Association, and the dangers to American Science conceived to be threatened thereby) have lost their weight with many, and that both the wisdom and the charm of the old organization have reestablished themselves in the minds and hearts of all who were in attendance on this last occasion.

Let not our American Association be likened, at least not essentially, to any other band of Scientists: to the British Association, for example, from which the name and migratory feature (but virtually we think these only) are adapted. As to objects and plan of organization, both are older than the British body; and scarce any resemblance appears between the *peculiar* features and "surroundings" of the two. Our democratic character, so strictly and constantly reasserting and reproducing itself, is a feature difficult to maintain in an oligocratic community, as the history of the British Association plainly enough shows, notwithstanding

the vigilance of the many true Scientists, *Nature's* noblemen. The popularity deemed essential to success in prosecuting its plans can only be secured, and its dignity in the eyes of the masses only asserted and maintained, by the *patronage* of the hereditary proprietors of the nation. Science, there, as in the times of feudalism, must still have its patrons, among kings and lords, altogether apart from scientific eminence and attainments; this being doubtless held as one of their prerogatives, part of the "divine right," a faith which we, in this favored land, only realize to ourselves as a traditionary myth of the dark ages. Such considerations clearly show us the important fact, that *this* is the only land wherein Science is assuming, and has already to some extent assumed, her true status; wherein only is she pursued for herself alone, and to secure for the race of man the bounties which she pours out from exhaustless springs.

The peculiar conditions which surround our American Association and its members, distinguish it quite as strongly, from all similar bodies. The vastness and newness of the field that lies before it, and the distances at which the members are sparsely scattered as yet over this field, are among the most salient points of singularity. In the expressive words of welcome of President WHEATLAND of the Essex Institute, at Salem, on the late occasion, depicting these "zealous and enthusiastic workers in science, scattered necessarily over a large extent of territory, and kept asunder by distance and the claims of professional duties; laboring amid all the inconveniences of solitude, and isolated from the sympathy and the counsel of those engaged in the same glorious enterprise, thus coming together, becoming acquainted with each other's social and scientific worth, comparing notes and contributing largely to scientific knowledge."

Stronger language still might be used, however, to convey full ideas of the extent of self-sacrifice generally required of an active member of the American Association.

Our limits forbid our adding on this occasion more than that the Salem meeting was in every sense a success; the attendance highly gratifying, both qualitatively and quantitatively; the proportion of the papers presented (more than 150 in all) which are of permanent value, unusually large; and the assiduity and hospitality of the Local Committee, and of the citizens of Salem generally, not surpassed on any previous occasion.—H. W.

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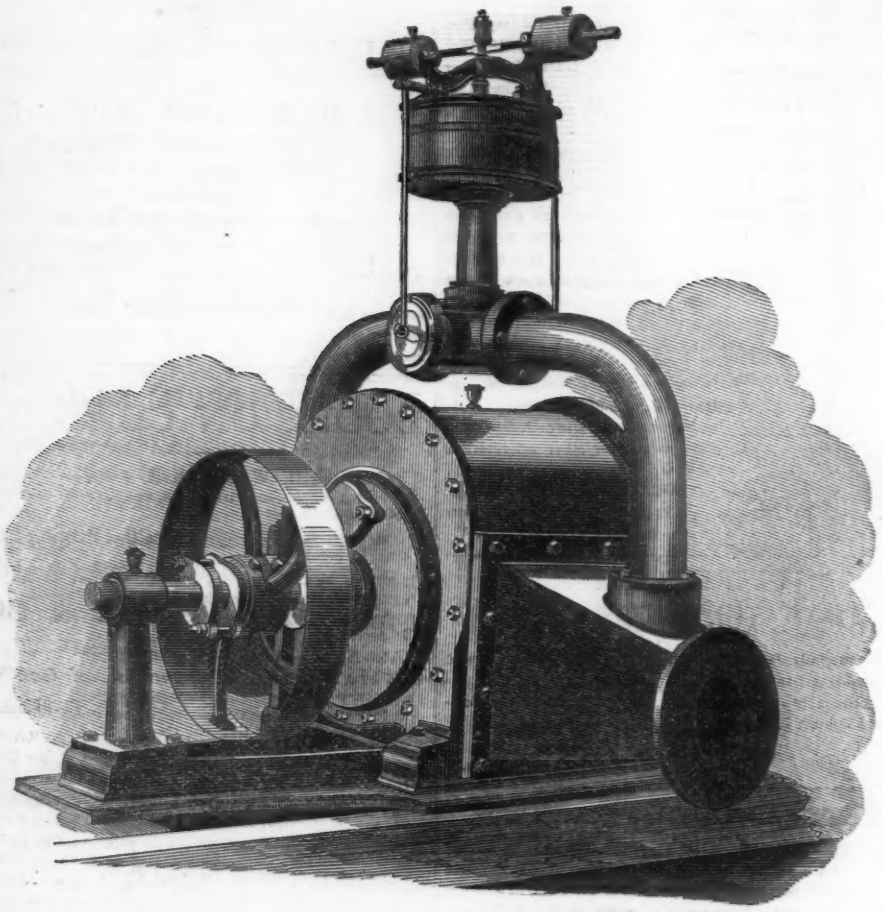

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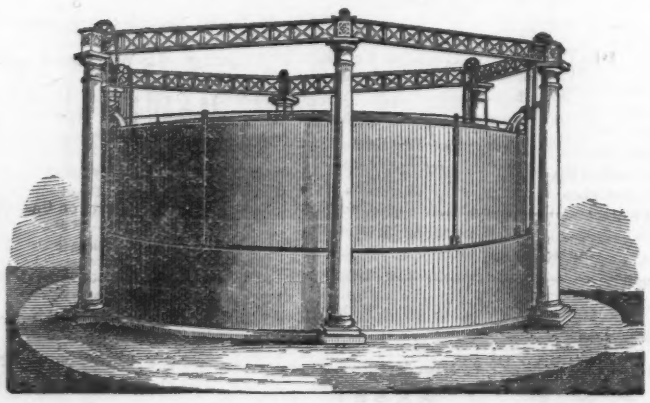

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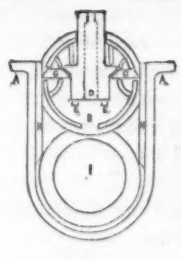

FIG. 3. FIG. 2.

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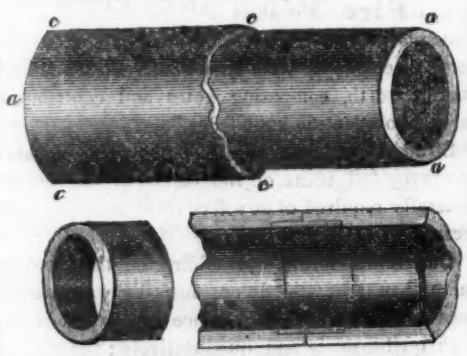

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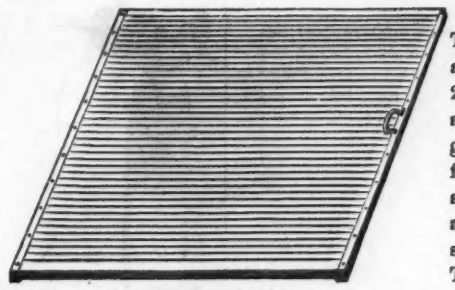

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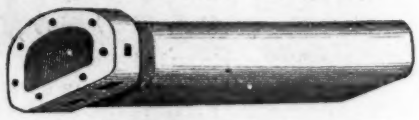

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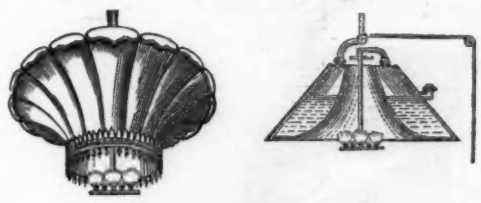

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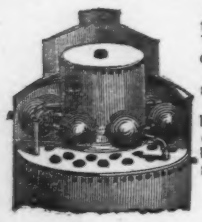

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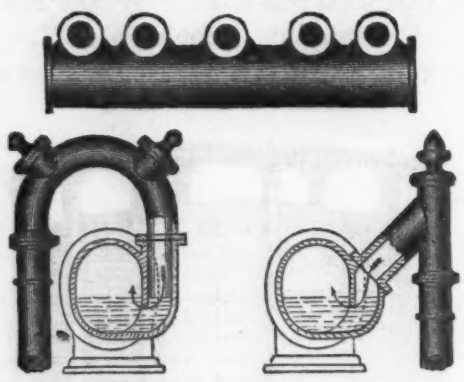

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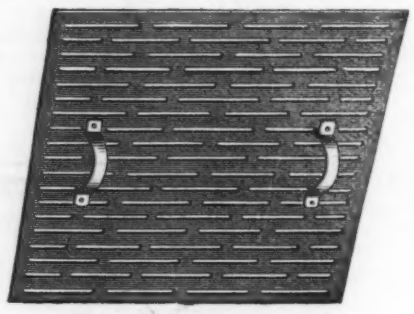

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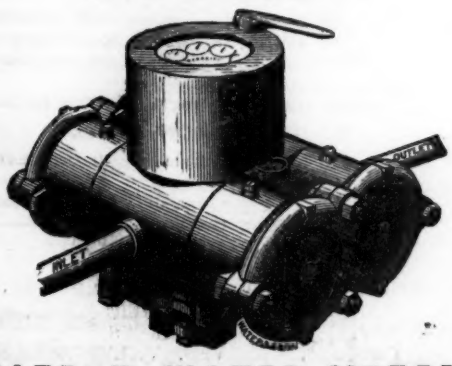

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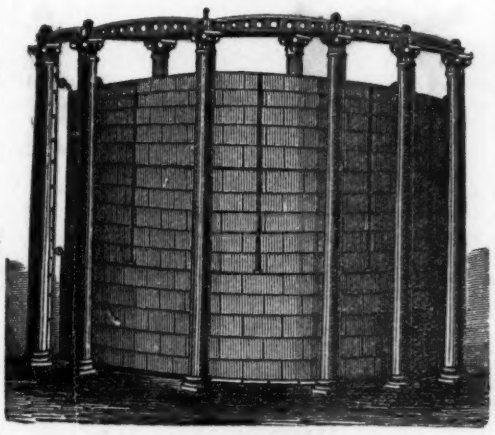

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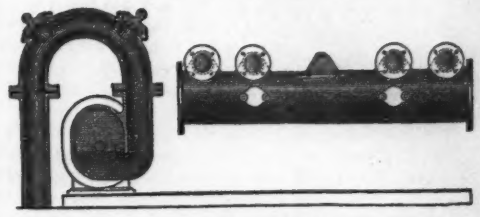

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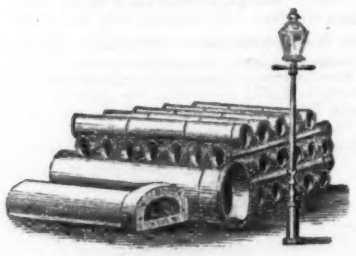

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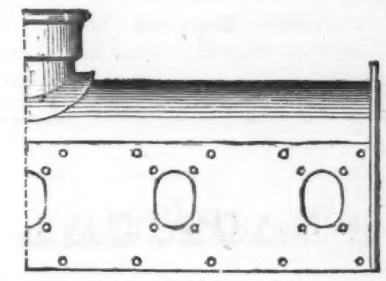

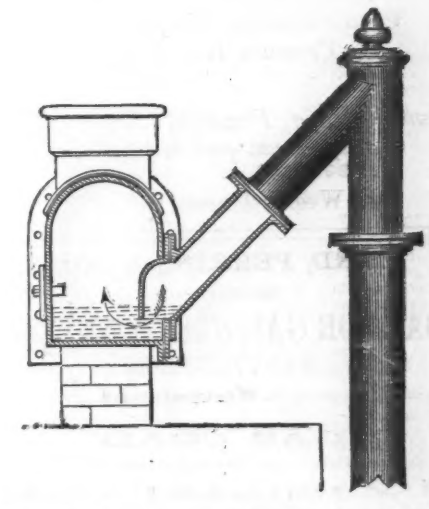

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